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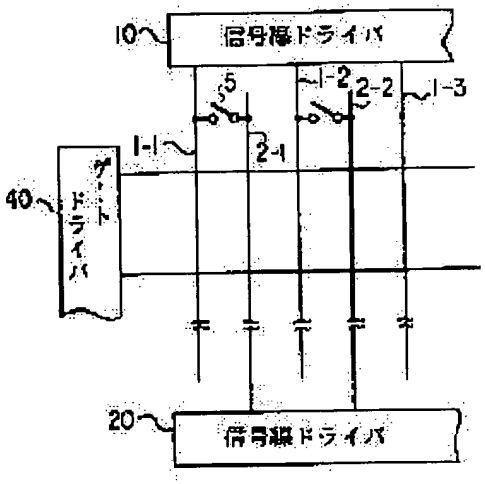
(54) LIQUID CRYSTAL DISPLAY DEVICE

(57)Abstract:

PURPOSE: To provide a liquid crystal display device capable of reproducing an image having an excellent image quality and whose power consumption is small in spite of adopting a signal line inversion driving.

CONSTITUTION: In the liquid crystal display device provided with plural signal lines 1 (1-1, 1-2,...) and signal lines 2 (2-1, 2-2,...) for writing an image signal on pixel electrodes arranged in a matrix and with signal line drivers 10, 20 inverse-driving lines being adjacent each other with respect to these signal lines 1, 2, semiconductor switches 5 composed of TFTs are respectively connected in between signal lines (in between 1-1 and 2-1, in between 1-2 and 2-2,...) at every adjacent two signal lines 1, 2 and these switches 5 are turned on in a period when the image signal is not inputted to signal lines.



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CLAIMS

[Claim(s)]
[Claim 1] The liquid crystal display which possesses the means which carries out the reversal drive of what adjoin the pixel electrode by which matrix arrangement was carried out to two or more signal lines for writing in a picture signal, and these signal lines, and the solid state switch connected between these signal lines for every two signal lines adjoin, and is characterized by the bird clapper.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] Especially this invention relates to the liquid crystal display of a signal-line reversal drive method with respect to a liquid crystal display.
[0002]
[Description of the Prior Art] In recent years, high resolution-ization (formation of many pixels) progresses and drive frequency is accelerating a liquid crystal display. The power supply level shift drive (Japanese Patent Application No. No. 48313 [four to]) which shifts the common reversal drive (JP,55-28649,A) which shakes a common electrode the polarity of a picture and reversely for the purpose of low-battery-izing Drive IC and making it correspond to a high speed signal in such a situation, and supply voltage synchronizing with the polarity of a picture is proposed.
[0003] However, since a common reversal drive must drive mass KOMON a level drive period (15 - 30 microsecond), power consumption increases. Moreover, since a mass power supply must be driven, a powerful drive circuit is newly needed, and also application is difficult for a power supply level shift drive to the drive which must drive a power supply at high speed, such as dot reversal. For this reason, now only within the signal-line reversal drive, it is carried out. Although this signal-line reversal drive has the feature which the horizontal cross talk produced since common resistance increases when it big-screen-izes cannot generate easily, since it is easy to generate the vertical cross talk by leak of TFT, the requirement specification to a TFT property becomes severe.
[0004] Furthermore, the method of changing the signal line which fixes a power supply, forms a switch in the interior of drive IC, and is driven for every field is proposed as a method of solving such a trouble (JP,3-51887,A, Japanese Patent Application No. No. 188299 [one to]). However, it becomes difficult to mount, since power consumption increases in order to have to reverse polarity for every line or the number of outputs from the up-and-down drive IC becomes double precision, when realizing the dot reversal drive which can perform high definition-ization by combining signal-line reversal and line reversal, even if it uses such a method.
[0005]
[Problem(s) to be Solved by the Invention] Thus, in the conventional liquid crystal display which performs a signal-line reversal drive, there was a problem that power consumption increased or quality of image deteriorated with a horizontal cross talk, a vertical cross talk, etc.
[0006] this invention was made in consideration of the above-mentioned situation, and the place made into the purpose has power consumption in offering the liquid crystal display which can reproduce the few good picture of quality of image, adopting a signal-line reversal drive.
[0007]
[Means for Solving the Problem] The following composition is used for this invention in order to solve the above-mentioned technical problem. That is, this invention is characterized by preparing a solid state switch between these signal lines for every two signal lines a reversal drive is carried out mutually and adjoin in the liquid crystal display equipped with the means which carries out the reversal drive of what

adjoin the pixel electrode by which matrix arrangement was carried out to two or more signal lines for writing in a picture signal, and these signal lines.
[0008] Here, the following are raised as a desirable embodiment of this invention.
(1) Connect between the signal lines for a solid state switch writing in the same chrominance signal in the case of color display.
(2) It comes to connect two solid state switches between a signal line and the signal line of another side in series, and the node of these solid state switches should be connected while a solid state switch adjoins to the pixel electrode.
(3) (2) One side is an n channel MOS transistor, another side should be a p channel MOS transistor, the gate of each transistor should make common connection of the two solid state switches, and they should be connected to the scanning line.
(4) Flow through a solid state switch in the period when the picture signal is not inputted into a signal line.
(5) A solid state switch should be the MOS transistor (TFT) formed in contest polysilicon or single crystal silicon.
(6) Form by making a signal-line driver into a part for contest polysilicon or single crystal silicon, and a display, and one.
[0009]
[Function] According to this invention, also in the dot reversal driving method for the ability to reduce the power consumption for driving a signal line for every field or frame, and reduce a vertical cross talk and a horizontal cross talk by operation of the solid state switch between adjoining signal lines, it becomes possible to reduce power consumption.
[0010] Moreover, by forming a solid state switch by the MOS transistor of contest polysilicon, and forming a signal-line driver in contest polysilicon by one further, even when the pitch of a signal line becomes fine, it can respond. Moreover, it becomes possible to reduce a vertical cross talk also in a signal-line reversal drive by composition which combines the MOS transistor of p channels and n channels as a solid state switch.
[0011]
[Example] First, before explaining an example, it examines by what factor the power consumption of the drive circuit (modular circuit) of a liquid crystal display is decided. Here, the power consumption by the bias current to which power consumption flows in direct current shall not include.
[0012] A drive circuit is fundamentally divided into a signal-line drive circuit, a buffer circuit, a control signal generating circuit, a common drive circuit, and a gate line drive circuit. Below, each is described in detail.
(1) a signal-line drive circuit -- although divided into a digital method and an analog method, since it is the drive IC for driving a signal line and OA picture is digital, this examines power consumption about the good digital method of adjustment
[0013] The drive IC of a digital method consists of the shift register which determines the sampling time of a signal fundamentally, the latch circuit which latches a digital signal, a D/A-conversion circuit which changes a digital signal into an analog signal, and an output buffer which drives a signal line. Here, since it is a latch circuit and an output buffer, these two factors that determine power consumption are considered.
[0014] maximum electric power consumption P1 of a latch circuit the input equivalent capacity concerning C1 and a sampling clock in the input equivalent capacity about a picture signal -- the sampling frequency of Cck and a picture -- fs ** -- if it carries out P1 =(C1+2Cck) xfs/2xV1 2 -- It is expressed with (1).
[0015] The maximum electric power consumption Pob of an output buffer is [capacity / signal-line] Nh about fh and the level number of pixels in Cs and level drive frequency. If it carries out Pob=Nh xCs xfh xVs 2 / 2 -- It is expressed with (2).
(2) Although a buffer circuit buffer circuit is the portion which carries out noise rejection and waveform shaping and supplies a stable signal to a signal-line drive circuit in response to the digital signal of an

input and it may be omitted, since it is fundamentally required, take into consideration. Maximum electric power consumption Pb of a buffer circuit Clock fs If input equivalent capacity of the circuit concerning Cbc and a picture signal in the input equivalent capacity of the related circuit is set to Cbp Pb =(2 Cbc+Cbp) xfs/2xVb 2 -- It is expressed with (3).
(3) a control signal generating circuit -- this, although it has gate-array-ized fundamentally and internal frequency changes with signals mainly -- sampling clock fs of a picture since related power consumption is considered to be an important factor -- the maximum electric power consumption Pga of the whole gate array -- clock fs the input equivalent capacity of the circuit concerning Cgac and a picture signal in the interior capacity of equivalence of the related circuit -- Cgap **, if it carries out Pga= (2Cgac+Cgap) xfs/2xVga2 -- It is expressed with (4).
(4) a common drive circuit -- this -- common capacity Cc the thing for driving -- it is -- maximum electric power consumption Pc of a common drive circuit common drive frequency -- fc ** -- if it carries out (fc is the half of the level drive frequency fh in common reversal) Pc =Cc xfc xVc 2 -- It is expressed with (5).
(5) a gate line drive circuit -- this -- capacity Cg of a gate line the thing for driving -- it is -- maximum electric power consumption Pg of a gate line drive circuit If drive frequency of a gate line is set to fg (usually level drive frequency fh) Pg =Cg xfg xVg 2 -- (6) It is expressed.
(6) the power consumption of the whole circuit, as mentioned above power consumption Pa11 of the whole circuit Pa11 =P1+Pob+Pb+Pga+Pc + Pg=(C1+2Cck) xfs/2xV1 2+Nh xCs xfh xVs 2/2+(2 Cbc+Cbp) xfs/2xVb 2+(2Cgac+Cgap) xfs/2xVga2+Cc xfc xVc 2+Cg xfh xVg 2 -- here It is Nh xCs >>Cg at common ** fixed voltage. When it carries out, Pa11 =(C1+2Cck+2 Cbc+Cbp+2Cgac+Cgap) xfs/2+V2+Nh xCs xfh/2xV2=Pa11 (C, f, V) -- It is set to (7) and becomes capacity C, and drive frequency f (a horizontal frequency and clock frequency of a picture) and the relation of voltage V.
[0016] this invention is (2). The power consumption for driving the signal line shown by the formula is reduced. That is, in order to have to reverse the polarity of a signal level for every line in dot reversal It sets at (2) ceremony and is fh. Since it becomes large with 15kHz or more, power consumption increases. Then, (2) Vs of a formula Power consumption is reduced by lowering. Below, the effect is examined based on an example.
(Example 1) Drawing 1 is drawing showing the important section composition of the liquid crystal display concerning the 1st example of this invention. Two or more signal lines driven by the signal-line drivers 10 and 20 are arranged, and two or more scanning lines driven with a gate driver 40 in the direction which intersects perpendicularly with these are arranged. And the pixel electrode is arranged through a switching element (for example, TFT) at each intersection of a signal line and the scanning line.
[0017] Although the composition so far is the same as that of conventionally common equipment, it has the structure where the solid state switch for short-circuiting between adjoining signal lines was installed, in this example. That is, the solid state switch 5 connected among these signal lines for every two signal lines adjoin is formed. This solid state switch 5 is the MOS transistor (TFT) formed for example, in the polysilicon contest film.
[0018] In addition, this example is a signal-line reversal drive method which drives an adjoining signal line with reversed polarity. That is, it is connected with the signal-line drivers 10 and 20 from which a signal line differs every other, and it is driven by negative polarity, and a signal line 1 (1-1, 1-2, --) is driven with straight polarity in a certain field, and it is driving [a signal line 2 (2-1, 2-2, --) drives a signal line 1 by negative polarity, and] the signal line 2 with straight polarity in the next field.
[0019] Thus, operation of this constituted equipment is explained. First taking the case of the drive of a signal line 1 and a signal line 2, it explains. The signal of negative polarity shall be written in straight polarity and a signal line 2 at a signal line 1, and charges Q1 and Q2 shall be held at each signal-line capacity C1 and C2.
[0020] Usually, although this charge is vainly thrown away in case the drive of the following reversed polarity is performed, at this example, power consumption can be lowered by using the charge for negating the next charge paying attention to adjoining signal lines being the signals of reversed polarity.

[0021] That is, a picture signal turns on a solid state switch 5 in the period which is not inputted into a signal line, and short-circuits the adjoining signal lines 1 and 2. The potential Vsb of each signal line after short-circuiting is Vsb=(Q1+Q2)/(C1+C2).
When coming out, and it is, for example, shakes common potential from 0 and driver voltage -5 to 5V, it is Q1=-Q2C1=C2. That is, it will be set to Vsb=0 supposing the signal of the level with the next signal line reverse [polarity] and same is impressed.
[0022] therefore -- since initial value should just drive from 0V that signal-line capacity must usually be driven from -5V to 5V -- (2) Vs of a formula the case where it was made to one half and power consumption is changed 1/2 by the case where supply voltage is not changed, as the result -- a maximum of -- it can decrease to one fourth However, when this is the case that correlation is strong and there is no correlation in the next signal level, an effect fades a little.
[0023] Moreover, if it becomes highly minute and a signal-line interval narrows, since it is desirable to create this switch in a panel, it is suitable to form in contest polysilicon which can be created with a glass substrate. Furthermore, if the signal-line driver itself is created with contest polysilicon, since the frame size of a panel module can also be miniaturized, it is still more effective.
(Example 2) Drawing 2 is drawing showing the important section composition of the electrochromatic display display concerning the 2nd example of this invention. Usually, as for the liquid crystal panel of a color, the color filter of RGB is attached to each pixel, and the next pixels serve as a different color. It is larger for an effect for drawing 2 to be an example in the vertical stripe array of RGB, and to connect the same powerful mutually related color filters with a switch in this case.
[0024] Then, in this example, the reversal drive of the signal line for writing in the same chrominance signal is carried out by adjoining things, and the solid state switch 5 is inserted in (B) between (G), 3-1, and 3-2 (not shown) between (R), 2-1, and 2-2, respectively between the signal lines for writing in the same chrominance signal of the RGB (for example, between 1-1 and 1-2). Even if it is such composition, the same effect as the 1st example is acquired.
[0025] In addition, the array of RGB cannot necessarily be restricted to a vertical stripe as shown in drawing 2 , and, also in other arrays (a delta array, G check RB array, etc.), can be applied.
(Example 3) Drawing 3 is drawing showing the important section composition of the liquid crystal display concerning the 3rd example of this invention. In this example, two solid state switches 5 are attached to each pixel, and signal lines 1 and 2 are connected through this switch 5. One side 5a of a switch is an n channel MOS transistor, and another side 5b is a p channel MOS transistor.
[0026] It sets in such composition and is Vmax about Vthn and the maximum voltage of a picture signal in the threshold of an n channel at the property of each switches 5a and 5b. If it carries out, it is the minimum value Vmin of Vthn >=Vmax and threshold Vthp of p channels, and a picture. If it carries out, the conditions of Vthp <=Vmin shall be satisfied. In this case, it is Vonn >=Vthn as shown in drawing 4 . If voltage Von is applied, only an n channel MOS transistor will be turned on and a picture signal will be written in from an n channel MOS transistor. Next, it is Voff as shown in drawing 4 . The MOS transistor of an n channel and a p channel can make both turn off by preparing between a straight polarity signal and a negative polarity signal. Subsequently, it is Vonp <=Vthp in order to make a p channel MOS transistor turn on. Voltage is applied and the signal of reversed polarity is inputted into a pixel.
[0027] That is, in the structure of drawing 3 , if it drives like drawing 4 , since a signal can be inputted from the left signal line 1, a signal-line driver should just drive the always same polar signal from the right signal line 2 in the next field at a certain time. Moreover, since the polarity of the surrounding signal line of a pixel is always the same also as quality of image, high definition LCD is realizable by the low power which neither the cross talk of the length produced in the usual signal-line reversal nor the cross talk of the longitudinal direction by common reversal also has.
[0028] In addition, this invention is not limited to each example mentioned above, it is the range which does not deviate from the summary, and can deform variously and can be carried out. For example, if it is the method which carries out the reversal drive not only of what was explained in the example but the signal line as a drive method of a pixel, it is applicable to various kinds of drive methods.

[0029]
[Effect of the Invention] Since the always same polar signal joins one signal line by using effectively the charge collected on the capacity of the signal line which was being made into futility until now by preparing a solid state switch between the adjoining signal lines by which a reversal drive is carried out, or forming the switch which changes an input to the signal line of straight polarity, and the signal line of negative polarity for every pixel according to this invention as explained in full detail above, it can low-power-ize sharply. Moreover, shortening of the connection pitch which became a problem by COG, TAB, etc. is solvable by using semiconductor detailed processes, such as LSI, by creating a switch with contest polysilicon.
[0030] Moreover, since the polarity of a signal line can write the same polar sign different [but] in a pixel by using the MOS transistor of a p channel and an n channel, pressure-proofing of the driver which drives a signal line can be raised, and it becomes a low cost and a low power. Furthermore, since the leakage current in each pixel can be made equivalent by positive and negative polarity, a cross talk can be reduced sharply.

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TECHNICAL FIELD

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PRIOR ART

[Description of the Prior Art] In recent years, high resolution-ization (formation of many pixels) progresses and drive frequency is accelerating a liquid crystal display. The power supply level shift drive (Japanese Patent Application No. No. 48313 [four to]) which shifts the common reversal drive (JP,55-28649,A) which shakes a common electrode the polarity of a picture and reversely for the purpose of low-battery-izing Drive IC and making it correspond to a high speed signal in such a situation, and supply voltage synchronizing with the polarity of a picture is proposed.
[0003] However, since a common reversal drive must drive mass KOMON a level drive period (15 - 30 microsecond), power consumption increases. Moreover, since a mass power supply must be driven, a powerful drive circuit is newly needed, and also application is difficult for a power supply level shift drive to the drive which must drive a power supply at high speed, such as dot reversal. For this reason, now only within the signal-line reversal drive, it is carried out. Although this signal-line reversal drive has the feature which the horizontal cross talk produced since common resistance increases when it big-screen-izes cannot generate easily, since it is easy to generate the vertical cross talk by leak of TFT, the requirement specification to a TFT property becomes severe.
[0004] Furthermore, the method of changing the signal line which fixes a power supply, forms a switch in the interior of drive IC, and is driven for every field is proposed as a method of solving such a trouble (JP,3-51887,A, Japanese Patent Application No. No. 188299 [one to]). However, it becomes difficult to mount, since power consumption increases in order to have to reverse polarity for every line or the number of outputs from the up-and-down drive IC becomes double precision, when realizing the dot reversal drive which can perform high definition-ization by combining signal-line reversal and line reversal, even if it uses such a method.

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EFFECT OF THE INVENTION

[Effect of the Invention] As explained in full detail above, in this invention, a solid state switch is prepared between the adjoining signal lines by which a reversal drive is carried out. Therefore, by using effectively the charge collected on the capacity of the signal line which was being made into futility until now, or forming the switch which changes an input to the signal line of straight polarity, and the signal line of negative polarity for every pixel, since the always same polar signal joins one signal line, it can low-power-ize sharply. Moreover, shortening of the connection pitch which became a problem by COG, TAB, etc. is solvable by using semiconductor detailed processes, such as LSI, by creating a switch with contest polysilicon.
[0030] Moreover, since the polarity of a signal line can write the same polar sign different [but] in a pixel by using the MOS transistor of a p channel and an n channel, pressure-proofing of the driver which drives a signal line can be raised, and it becomes a low cost and a low power. Furthermore, since the leakage current in each pixel can be made equivalent by positive and negative polarity, a cross talk can be reduced sharply.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] Thus, in the conventional liquid crystal display which performs a signal-line reversal drive, there was a problem that power consumption increased or quality of image deteriorated with a horizontal cross talk, a vertical cross talk, etc.
[0006] this invention was made in consideration of the above-mentioned situation, and the place made into the purpose has power consumption in offering the liquid crystal display which can reproduce the few good picture of quality of image, adopting a signal-line reversal drive.

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MEANS

[Means for Solving the Problem] The following composition is used for this invention in order to solve the above-mentioned technical problem. That is, this invention is characterized by preparing a solid state switch between these signal lines for every two signal lines a reversal drive is carried out mutually and adjoin in the liquid crystal display equipped with the means which carries out the reversal drive of what adjoin the pixel electrode by which matrix arrangement was carried out to two or more signal lines for writing in a picture signal, and these signal lines.
[0008] Here, the following are raised as a desirable embodiment of this invention.
(1) Connect between the signal lines for a solid state switch writing in the same chrominance signal in the case of color display.
(2) It comes to connect two solid state switches between a signal line and the signal line of another side in series, and the node of these solid state switches should be connected while a solid state switch adjoins to the pixel electrode.
(3) (2) One side is an n channel MOS transistor, another side should be a p channel MOS transistor, the gate of each transistor should make common connection of the two solid state switches, and they should be connected to the scanning line.
(4) Flow through a solid state switch in the period when the picture signal is not inputted into a signal line.
(5) A solid state switch should be the MOS transistor (TFT) formed in contest polysilicon or single crystal silicon.
(6) Form by making a signal-line driver into a part for contest polysilicon or single crystal silicon, and a display, and one.

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OPERATION

[Function] According to this invention, also in the dot reversal driving method for the ability to reduce the power consumption for driving a signal line for every field or frame, and reduce a vertical cross talk and a horizontal cross talk by operation of the solid state switch between adjoining signal lines, it becomes possible to reduce power consumption.
[0010] Moreover, by forming a solid state switch by the MOS transistor of contest polysilicon, and forming a signal-line driver in contest polysilicon by one further, even when the pitch of a signal line becomes fine, it can respond. Moreover, it becomes possible to reduce a vertical cross talk also in a signal-line reversal drive by composition which combines the MOS transistor of p channels and n channels as a solid state switch.

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EXAMPLE

[Example] First, before explaining an example, it examines by what factor the power consumption of the drive circuit (modular circuit) of a liquid crystal display is decided. Here, the power consumption by the bias current to which power consumption flows in direct current shall not include.
[0012] A drive circuit is fundamentally divided into a signal-line drive circuit, a buffer circuit, a control signal generating circuit, a common drive circuit, and a gate line drive circuit. Below, each is described in detail.
(1) a signal-line drive circuit -- although divided into a digital method and an analog method, since it is the drive IC for driving a signal line and OA picture is digital, this examines power consumption about the good digital method of adjustment
[0013] The drive IC of a digital method consists of the shift register which determines the sampling time of a signal fundamentally, the latch circuit which latches a digital signal, a D/A-conversion circuit which changes a digital signal into an analog signal, and an output buffer which drives a signal line. Here, since it is a latch circuit and an output buffer, these two factors that determine power consumption are considered.
[0014] maximum electric power consumption P1 of a latch circuit the input equivalent capacity concerning C1 and a sampling clock in the input equivalent capacity about a picture signal -- the sampling frequency of Cck and a picture -- fs ** -- if it carries out P1 =(C1+2Cck) xfs/2xV1 2 -- It is expressed with (1).
[0015] The maximum electric power consumption Pob of an output buffer is [capacity / signal-line] Nh about fh and the level number of pixels in Cs and level drive frequency. If it carries out Pob=Nh xCs xfh xVs 2 / 2 -- It is expressed with (2).
(2) Although a buffer circuit buffer circuit is the portion which carries out noise rejection and waveform shaping and supplies a stable signal to a signal-line drive circuit in response to the digital signal of an input and it may be omitted, since it is fundamentally required, take into consideration. Maximum electric power consumption Pb of a buffer circuit Clock fs If input equivalent capacity of the circuit concerning Cbc and a picture signal in the input equivalent capacity of the related circuit is set to Cbp Pb =(2 Cbc+Cbp) xfs/2xVb 2 -- It is expressed with (3).
(3) a control signal generating circuit -- this, although it has gate-array-ized fundamentally and internal frequency changes with signals mainly -- sampling clock fs of a picture since related power consumption is considered to be an important factor -- the maximum electric power consumption Pga of the whole gate array -- clock fs the input equivalent capacity of the circuit concerning Cgac and a picture signal in the interior capacity of equivalence of the related circuit -- Cgap **, if it carries out Pga= (2Cgac+Cgap) xfs/2xVga2 -- It is expressed with (4).
(4) a common drive circuit -- this -- common capacity Cc the thing for driving -- it is -- maximum electric power consumption Pc of a common drive circuit common drive frequency -- fc ** -- if it carries out (fc is the half of the level drive frequency fh in common reversal) Pc =Cc xfc xVc 2 -- It is expressed with (5).
(5) a gate line drive circuit -- this -- capacity Cg of a gate line the thing for driving -- it is -- maximum

electric power consumption Pg of a gate line drive circuit If drive frequency of a gate line is set to fg (usually level drive frequency fh) Pg =Cg xfg xVg 2 -- (6) It is expressed.
(6) the power consumption of the whole circuit, as mentioned above power consumption Pa11 of the whole circuit Pa11 =P1+Pob+Pb+Pga+Pc + Pg=(C1+2Cck) xfs/2xV1 2+Nh xCs xfh xVs 2/2+(2 Cbc+Cbp) xfs/2xVb 2+(2Cgac+Cgap) xfs/2xVga2+Cc xfc xVc 2+Cg xfh xVg 2 -- here It is Nh xCs >>Cg at common ** fixed voltage. When it carries out, Pa11 =(C1+2Cck+2 Cbc+Cbp+2Cgac+Cgap) xfs/2+V2+Nh xCs xfh/2xV2=Pa11 (C, f, V) -- It is set to (7) and becomes capacity C, and drive frequency f (a horizontal frequency and clock frequency of a picture) and the relation of voltage V.
[0016] this invention is (2). The power consumption for driving the signal line shown by the formula is reduced. That is, in order to have to reverse the polarity of a signal level for every line in dot reversal It sets at (2) ceremony and is fh. Since it becomes large with 15kHz or more, power consumption increases. Then, (2) Vs of a formula Power consumption is reduced by lowering. Below, the effect is examined based on an example.
(Example 1) Drawing 1 is drawing showing the important section composition of the liquid crystal display concerning the 1st example of this invention. Two or more signal lines driven by the signal-line drivers 10 and 20 are arranged, and two or more scanning lines driven with a gate driver 40 in the direction which intersects perpendicularly with these are arranged. And the pixel electrode is arranged through a switching element (for example, TFT) at each intersection of a signal line and the scanning line.
[0017] Although the composition so far is the same as that of conventionally common equipment, it has the structure where the solid state switch for short-circuiting between adjoining signal lines was installed, in this example. That is, the solid state switch 5 connected among these signal lines for every two signal lines adjoin is formed. This solid state switch 5 is the MOS transistor (TFT) formed for example, in the polysilicon contest film.
[0018] In addition, this example is a signal-line reversal drive method which drives an adjoining signal line with reversed polarity. That is, it is connected with the signal-line drivers 10 and 20 from which a signal line differs every other, and it is driven by negative polarity, and a signal line 1 (1-1, 1-2, --) is driven with straight polarity in a certain field, and it is driving [a signal line 2 (2-1, 2-2, --) drives a signal line 1 by negative polarity, and] the signal line 2 with straight polarity in the next field.
[0019] Thus, operation of this constituted equipment is explained. First taking the case of the drive of a signal line 1 and a signal line 2, it explains. The signal of negative polarity shall be written in straight polarity and a signal line 2 at a signal line 1, and charges Q1 and Q2 shall be held at each signal-line capacity C1 and C2.
[0020] Usually, although this charge is vainly thrown away in case the drive of the following reversed polarity is performed, at this example, power consumption can be lowered by using the charge for negating the next charge paying attention to adjoining signal lines being the signals of reversed polarity.
[0021] That is, a picture signal turns on a solid state switch 5 in the period which is not inputted into a signal line, and short-circuits the adjoining signal lines 1 and 2. The potential Vsb of each signal line after short-circuiting is Vsb=(Q1+Q2)/(C1+C2).
When coming out, and it is, for example, shakes common potential from 0 and driver voltage -5 to 5V, it is Q1=-Q2C1=C2. That is, it will be set to Vsb=0 supposing the signal of the level with the next signal line reverse [polarity] and same is impressed.
[0022] therefore -- since initial value should just drive from 0V that signal-line capacity must usually be driven from -5V to 5V -- (2) Vs of a formula the case where it was made to one half and power consumption is changed 1/2 by the case where supply voltage is not changed, as the result -- a maximum of -- it can decrease to one fourth However, when this is the case that correlation is strong and there is no correlation in the next signal level, an effect fades a little.
[0023] Moreover, if it becomes highly minute and a signal-line interval narrows, since it is desirable to create this switch in a panel, it is suitable to form in contest polysilicon which can be created with a glass substrate. Furthermore, if the signal-line driver itself is created with contest polysilicon, since the frame size of a panel module can also be miniaturized, it is still more effective.

(Example 2) Drawing 2 is drawing showing the important section composition of the electrochromatic display display concerning the 2nd example of this invention. Usually, as for the liquid crystal panel of a color, the color filter of RGB is attached to each pixel, and the next pixels serve as a different color. It is larger for an effect for drawing 2 to be an example in the vertical stripe array of RGB, and to connect the same powerful mutually related color filters with a switch in this case.
[0024] Then, in this example, the reversal drive of the signal line for writing in the same chrominance signal is carried out by adjoining things, and the solid state switch 5 is inserted in (B) between (G), 3-1, and 3-2 (not shown) between (R), 2-1, and 2-2, respectively between the signal lines for writing in the same chrominance signal of the RGB (for example, between 1-1 and 1-2). Even if it is such composition, the same effect as the 1st example is acquired.
[0025] In addition, the array of RGB cannot necessarily be restricted to a vertical stripe as shown in drawing 2 , and, also in other arrays (a delta array, G check RB array, etc.), can be applied.
(Example 3) Drawing 3 is drawing showing the important section composition of the liquid crystal display concerning the 3rd example of this invention. In this example, two solid state switches 5 are attached to each pixel, and signal lines 1 and 2 are connected through this switch 5. One side 5a of a switch is an n channel MOS transistor, and another side 5b is a p channel MOS transistor.
[0026] It sets in such composition and is Vmax about Vthn and the maximum voltage of a picture signal in the threshold of an n channel at the property of each switches 5a and 5b. If it carries out, it is the minimum value Vmin of Vthn >=Vmax and threshold Vthp of p channels, and a picture. If it carries out, the conditions of Vthp <=Vmin shall be satisfied. In this case, it is Vonn >=Vthn as shown in drawing 4 . If voltage Von is applied, only an n channel MOS transistor will be turned on and a picture signal will be written in from an n channel MOS transistor. Next, it is Voff as shown in drawing 4 . The MOS transistor of an n channel and a p channel can make both turn off by preparing between a straight polarity signal and a negative polarity signal. Subsequently, it is Vonp <=Vthp in order to make a p channel MOS transistor turn on. Voltage is applied and the signal of reversed polarity is inputted into a pixel.
[0027] That is, in the structure of drawing 3 , if it drives like drawing 4 , since a signal can be inputted from the left signal line 1, a signal-line driver should just drive the always same polar signal from the right signal line 2 in the next field at a certain time. Moreover, since the polarity of the surrounding signal line of a pixel is always the same also as quality of image, high definition LCD is realizable by the low power which neither the cross talk of the length produced in the usual signal-line reversal nor the cross talk of the longitudinal direction by common reversal also has.
[0028] In addition, this invention is not limited to each example mentioned above, it is the range which does not deviate from the summary, and can deform variously and can be carried out. For example, if it is the method which carries out the reversal drive not only of what was explained in the example but the signal line as a drive method of a pixel, it is applicable to various kinds of drive methods.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] Drawing showing the important section composition of the liquid crystal display concerning the 1st example.
[Drawing 2] Drawing showing the important section composition of the liquid crystal display concerning the 2nd example.
[Drawing 3] Drawing showing the important section composition of the liquid crystal display concerning the 3rd example.
[Drawing 4] Drawing showing the outline of the gate drive wave in the 3rd example.
[Description of Notations]
1, 2, 3 -- Signal line
5 -- Solid state switch
10 20 -- Signal-line driver
40 -- Gate driver

[Translation done.]

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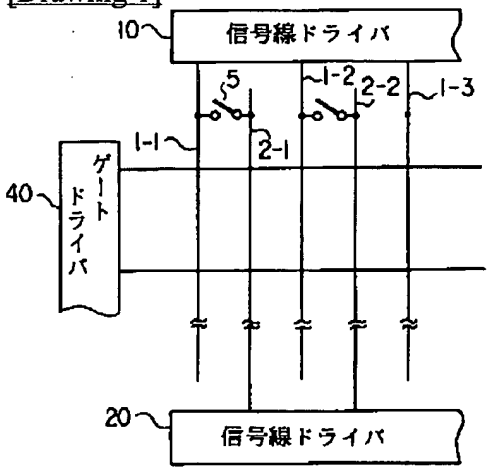
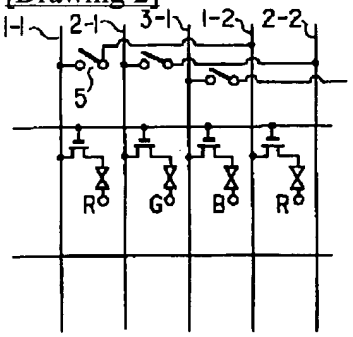
DRAWINGS

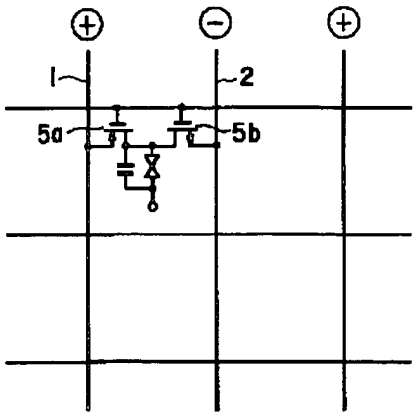
[Drawing 1]



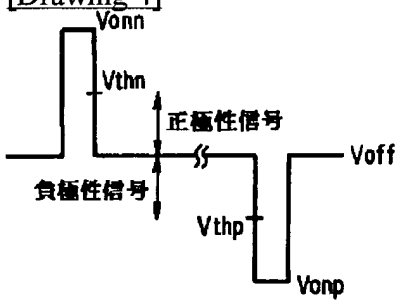
[Drawing 2]



[Drawing 3]



[Drawing 4]



[Translation done.]

DERWENT-ACC-NO: 1995-304550

DERWENT-WEEK: 199540

TITLE: Liq crystal display appts - has device which performs inversion drive for signals on signal lines and semiconductor switch connected between two adjacent signal lines NoAbstract

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Title - TIX (1):

Liq crystal display appts - has device which performs inversion drive for signals on signal lines and semiconductor switch connected between two adjacent signal lines NoAbstract

Standard Title Terms - TTX (1):

LIQUID CRYSTAL DISPLAY APPARATUS DEVICE PERFORMANCE INVERT DRIVE SIGNAL SIGNAL LINE SEMICONDUCTOR SWITCH CONNECT TWO ADJACENT SIGNAL LINE NOABSTRACT

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